

Deep Space 1's Remote Agent passes tests

It's one small step in the history of robotic space flight, but it may turn out to be one giant leap for computer-kind: Artificial intelligence software in primary command of a spacecraft has for the first time has been successfully tested.

Known as Remote Agent, the software operating JPL's Deep Space 1 spacecraft and its futuristic ion engine underwent a series of tests starting Monday, May 17 and continuing periodically through May 21. The question: Can a spacecraft function entirely on its own nearly 120 million kilometers (75 million miles) from Earth, without detailed instructions from the ground?

"The testing of the Remote Agent accomplished 100 percent of the planned objectives," said Dr. Marc Rayman, Deep Space 1's chief mission engineer and deputy mission manager.

The test efforts received widespread support from throughout JPL. According to Deep Space 1 Mission Manager Dr. Philip Varghese, approximately 16 people each from Divisions 31 and 34 contributed, along with about seven from Division 36, several from Divisions 33, 35 and Section 746, and further support from Division 32 and Section 920.

Remote Agent consists of a sophisticated set of computer programs that act as an agent of the operations team on board the remote spacecraft, Rayman said. Rather than have humans do the detailed planning necessary to carry out desired tasks, Remote Agent formulates its own plans, using high level goals provided by the operations team. Remote Agent devises its plan by combining those goals with its detailed knowledge of both the condition of the spacecraft and principles of how to operate it. It then executes that plan, constantly monitoring its progress. If problems develop, Remote Agent in many cases fixes them or works around them. If it cannot, it can request help from ground controllers.

"On May 17 and 18, Remote Agent debuted by formulating a plan and then executing it," Rayman said. "When it encountered a simulated failure—a surprise challenge presented to it by the operations team—it successfully overcame it. On Tuesday, a bug in the complex software was discovered that prevented Remote Agent from completing the test. The flaw in the software never manifested itself during the extensive ground-test program, and the successful identification and diagnosis of the bug was an important illustration of the value of testing an advanced technology on a flying spacecraft."



The bug is easily correctable for the future, but there was insufficient time to fix it and continue the tests during the window for the Remote Agent experiment. "But once we knew about it, analysis showed that the risk of it interfering with a new test was acceptable," Rayman noted. "Taking advantage of the ease of generating a new set of goals for Remote Agent, the team conducted another experiment on May 21 that captured all the remaining objectives for the testing of the Remote Agent architecture. In that experiment, Remote Agent was faced with three more (simulated) failures, each requiring a different kind of response.

"When it detected that an electronics unit had failed, Remote Agent fixed it by reactivating it. Then a sensor failed, and Remote Agent correctly recognized the problem was with the sensor, not the device it was sensing." This pair of problems is akin to finding that the engine warning light has come on in your car, Rayman said. "The light can mean one of two things: either the engine has a problem or the light has a problem. In each case, Remote Agent correctly distinguished which situation it was in.

The last test for the system sent by the operations team was one of the small thrusters, used to control the spacecraft's orientation, being stuck closed. Remote Agent correctly responded by switching to an alternate spacecraft control mode that did not depend upon the useless thruster. Remote Agent accomplished other tasks during the experiment as well.

"Remote Agent can create and carry out its own plans to achieve the mission goals that we give it," said Dr. Doug Bernard, Remote Agent manager at JPL. "This technology could allow us to pursue solar system exploration missions

that only a few years ago would have been considered too elaborate, too costly or excessively dependent on teams of Earth-bound controllers."

The Remote Agent software package features three components: the Planner/Scheduler, the Executive and one called Livingstone.

The Planner takes general goals and determines detailed activities needed to achieve the goals. The test included asking the Planner to achieve broad goals such as, "Find your position, and fire your ion engine whenever practical." If a hardware problem develops that prevents execution of the plan, the Planner makes a new plan, taking into account degraded capabilities.

The Executive interprets the plans and adds more detail to them, then issues commands to the flight software, coordinating the three parts of Remote Agent. Some commands turn the spacecraft to point in a different direction. Other commands ask the onboard camera to take pictures of asteroids and stars for navigation purposes.

Livingstone acts like a doctor, monitoring the spacecraft's health. If something goes wrong, Livingstone tells the Executive there is a problem. The Executive consults the "doctor" for simple procedures that may quickly remedy the problem. For example, if the camera does not respond, a quick fix is to turn the camera off and then on again. If this does not work, the Executive asks the Planner for a new plan that still achieves mission goals. If the problem is too serious, the software gives up and waits for help from Earth.

The spacecraft continues on course for a July 29 interception of asteroid 1992 KD. "The encounter," Rayman said, "while not a critical part of the mission, will allow a very challenging final test of a portion of Deep Space 1's autonomous navigation system and the bonus opportunity to return science data." □

OPEN HOUSE NEXT WEEKEND

JPL's annual open house is set for next Saturday and Sunday, June 5 and 6. For a schedule of displays and events, see page 3.

Special Events Calendar

Ongoing

Alcoholics Anonymous—Meeting at 11:30 a.m. Mondays, Tuesdays, Thursdays (women only) and Fridays. For more information, call Occupational Health Services at ext. 4-3319.

Copependents Anonymous—Meeting at noon on Wednesdays. Call Occupational Health Services at ext. 4-3319.

Gay, Lesbian and Bisexual Support Group—Meets the first and third Fridays of the month at noon in Building 111-117. Call employee assistance counselor Cynthia Cooper at ext. 4-3680 or Randy Herrera at ext. 3-0664.

Parent Support Group—Meets the fourth Tuesday of the month at noon. For location, call Jayne Dutra at ext. 4-6400.

Senior Caregivers Support Group—Meets the second and fourth Wednesdays of the month at 6:30 p.m. at the Senior Care Network, 837 S. Fair Oaks Ave., Pasadena, conference room #1. Call (626) 397-3110.

Friday, May 28

“Advanced Materials: Bridging the Gap Between Natural and Synthetic Polymers”—Caltech professors David Tirrell, Julia Kornfield and Robert Grubbs will speak at 4 p.m. in the campus’ Baxter Lecture Hall. An abstract and list of other seminars are available online at http://www.cco.caltech.edu/~koonin/CCE0_1seminars.html.

At the Piano—James Boyk will perform classical pieces at 8 p.m. in Caltech’s Dabney Lounge. Admission is free. For information, call (626) 395-4652.

Sat., May 29–Sun., May 30

“Trojan Women”—Presented by Theater Arts at Caltech, this production features JPL staff as well as Caltech students, faculty and staff. To be held 4 p.m. outdoors at the campus’ Braun Court. Tickets are \$15. For information, call (626) 395-4652.

Sunday, May 30

At the Piano—James Boyk will perform classical pieces at 3 p.m. in Caltech’s Dabney Lounge. Admission is free. Call (626) 395-4652.

Tuesday, June 1

JPL Gamers Club—Meeting at noon in Building 301-227.

JPL Genealogy Club—Meeting at noon in Building 301-169.

Wednesday, June 2

Associated Retirees of JPL/Caltech Board—Meeting at 10 a.m. at the Caltech Credit Union, 528 Foothill Blvd., La Cañada.

JPL Drama Club—Meeting at noon in Building 301-127.

Thursday, June 3

JPL Gun Club—Meeting at noon in Building 183-328.

Retirement Benefits—TIAA-CREF representative Cindy Wilson will explain the options available to retirees for distributing their benefits. Her discussion will include retirement cashability, annuity options, minimum distribution, cash withdrawal options and interest-only payments. From noon to 1 p.m. and 2:30 to 3:30 p.m. in Building 180-101.

Friday, June 4

“Simulations—Bridging Atomic to Systems Scale—Caltech professors William Goddard and Konstantinos Giapis will give this seminar at 4 p.m. in the campus’ Baxter Lecture Hall.

ERC Closure—Due to JPL open house preparations, the ERC office will be closed from noon today until 9 a.m. Tuesday, June 8.

Fireworks Spectacular—*Last day to purchase tickets at the ERC for the annual July 4 show at the Hollywood Bowl.* The event begins at 7:30 p.m. and tickets are \$25.

JPL Dance Club—Meeting at noon in Building 300-217.

Sat., June 5–Sun., June 6

“Trojan Women”—This production features JPL staff as well as Caltech students, faculty and staff. To be held 4 p.m. outdoors at the campus’ Braun Court. Tickets are \$15. Call (626) 395-4652.

Tuesday, June 8

JPL Stamp Club—Meeting at noon in Building 183-328.

Wednesday, June 9

JPL Drama Club—Meeting at noon in Building 301-127.

JPL Toastmasters Club—Meeting at 5:30 p.m. in the Building 167 conference room. Guests welcome. For more information, contact Mary Sue O’Brien at ext. 4-5090.

SESPD Lecture—Dr. Marc Rayman, deputy mission manager and chief mission engineer for Deep Space 1, will speak at 11 a.m. in Building 180-101.

Thursday, June 10

Von Kármán Lecture Series—James Polk, supervisor of the Advanced Propulsion Technology Group, and Stephanie Leifer, advanced propulsion concepts program manager, will speak at 7 p.m. in von Kármán Auditorium. Open to the public.

Friday, June 11

Dodger Baseball—*Last day to purchase tickets at the ERC for the June 22, 7:10 p.m. game between the Dodgers and the San Diego Padres (Cooler Bag Night).* Tickets are \$13.

JPL Dance Club—Meeting at noon in Building 300-217.

JPL Perl Users Group—Meeting at noon in Building 301-127.

Von Kármán Lecture Series—James Polk, supervisor of the Advanced Propulsion Technology Group, and Stephanie Leifer, advanced propulsion concepts program manager, will speak at 7 p.m. in The Forum at Pasadena City College, 1570 E. Colorado Blvd. Open to the public.

May NOVA winners announced

The winners of JPL’s Notable Organizational Value-Added (NOVA) awards for May have been announced:

Section 194: Karen Searle.

Section 331: Thomas Jedrey.

Section 334: Bruce Chapman, Anhua Chu, Wendy Edelstine, Jeffery Hilland, Eastwood Im, Son Nghiem, Ernesto Rodriguez, Scott Shaffer, Yuhshyen Shen, Louise Veilleux.

Section 344: Udo Lieneweg.

Section 351: Lee Johnsen.

Section 354: Laura Newlin.

Section 385: Quiesup Kim.

Section 388: Michael Bull, Peter Glover, Michael Mueller, Carol Stanley, Costin Radulescu, Pamela Woncik.

Section 389: Jayne Dutra, George Ritchey.

Section 391: Christine Anne Corrigan.

Section 393: Anil Agrawal,

Erich Corduan, Henry Dillard, William Duquette, Joseph Hutcherson, Scott Markham, William Mathews, Thomas McVittie, Myriam Ruiz, Steve Scandore, Sandi Thomas.

Section 394: James Abrea, Fannie Chun-Fang Chen, Harvey Chien, Don Germann, R. Brent Mead, Rebecca Martinez, Brian Vickers.

Section 500: Pamela Brenner, Gary McCutcheon, Kimberly Shepard, Suzette Carrera, Herald Christian III, Alan Hoffman, Richard Kuberry, Kin Fung Man, Thang Pham, Carol Young.

Section 506: Stephen Bolin, Lissa Galbraith, Kirk Olsen, Richard Paynter, Don Potter, Thomas Ramsey, Robert Vincent.

Section 507: James Coss, Ken Evans, Linda Facto, Robert Gaudin, R. David Gerke,

See NOVA, page 7

Open house to showcase the best of JPL

JPL—Yesterday, Today and Tomorrow is theme for June 5–6 event

Open house exhibits will be presented outdoors in five theme areas:

<i>Theme</i>	<i>Location</i>
Area A: Solar System	
A1 Our Star and Solar System	Building 180 parking lot
A2 Mars Exploration	Loki Road (Mars Yard parking area)
A3 Cassini Mission to Saturn	Between Buildings 179 and 170
Area B: Earth	
B1 Earth: Our Home Planet	Mariner Road, just east of mall
Area C: Children's Activities	
C1 Hands-On Activities	Mall, north of Building 168
C2 Build Your Own Spacecraft	Mall, north of Building 183
C3 Face Painting and Drawing	Mall, north of Building 183
C4 Child Educational Center	Mall, north of Building 183
C5 Live Entertainment	Mall, between Buildings 167 and 183
C6 See Yourself Fly in Space	South of von Kármán Auditorium
Area D: Universe	
D1 Seeing Beyond the Visible	Building 301 patio
Area E: Technology	
E1 New Methods and Spin-Offs	Building 303 parking area

Indoor presentations (starting at main entrance):

<i>Building</i>	<i>Presentation</i>
186 (von Kármán Auditorium)	"Welcome to Outer Space" multimedia production, spacecraft models, TV studio
168 (Instrument Systems Lab)	Remote sensing and data processing systems, animation, 3-D systems
301 (Central Engineering)	Project Design Center, Design Hub
179 (Spacecraft Assembly Facility)	High Bay 2 clean room, Flight System Testbed
170 (Spacecraft Fabrication Facility)	"Art to Part" fabrication demonstration
167 (Cafeteria conference room)	Telescopes In Education, multimedia, JPL web sites, educational CD-ROMs
180 (Administration)	Superfund project display, discoveries and future missions
230 (Space Flight Operations Facility)	Deep Space Operations Center
111 (Technical Information Library)	Reference resources, JPL Archives
79 (Low-Temperature Laboratory)	Cryogenic phenomena
148 (Electric Propulsion Laboratory)	Live ion propulsion engine test
150 (25-foot Space Simulator)	Space conditions demonstration

General information

Hours of operation

9 a.m. to 5 p.m. Saturday and Sunday.

Parking

JPL personnel are encouraged to park in the east lot, where trams will bring visitors on Lab.

Cafeteria

The Building 167 cafeteria will be open to the public from 9 a.m. to 4 p.m. For JPL employees working during the open house, it will open at 7:30 a.m. Snacks and soft drinks will be available on the mall throughout the day.

Questions

Public Services Office, ext. 4-0112.

From visitor one year to volunteer the next

About a year ago, Roger Wilcox was one of more than 50,000 visitors to the Laboratory's open house. This year, when the annual showcase is held June 5 and 6, he will be among the many JPLers helping to share the wonders of space science with fellow employees and the public.

Last year, Tony Fonseca of Section 357 set up and operated the computerized Bengal Waterjet machine in the Spacecraft Fabrication Facility (Building 170) to cut JPL key fobs for open house visitors. Using a high-pressure water-jet stream, the tool cuts precision parts from two-thousandths of an inch to eight inches thick. And its computer can be programmed to produce hundreds of identical copies.

The display intrigued Wilcox. After meeting and talking with Fonseca at the Bengal Waterjet, he decided that JPL would be a fascinating place to work and that he would like to seek a position.

About a week later, he met with Section 357 group supervisors Roger Okamoto and Darrol Houser. A few weeks after that, his resume had been reviewed, interviews conducted and he was on the job as a technician, providing diverse skills to the Spacecraft Fabrication

See Volunteer, page 7

Hubble, MGS track Mars storms

What a difference a few days make when you're tracking mid-summer weather on Mars, which is near its closest approach to Earth in nearly eight years.

On April 27, NASA's Hubble Space Telescope imaged an enormous cyclonic system composed of water ice clouds, raging in the planet's northern polar regions. However, by April 30 the JPL-managed Mars Global Surveyor spacecraft, in orbit around the red planet, captured images that showed what appeared to be normal cloud patterns for this time of year. In the north polar region, temperature differences between bright areas of year-round ice and dark areas of sand and rock create strong winds that mix the atmosphere and create waves of clouds that swirl around the polar cap. The motion of the clouds viewed in the images is typical for this season on Mars,

and shows forms often seen on Earth.

"Mars Global Surveyor, using the Mars orbiter camera, orbiter laser altimeter, and thermal emission spectrometer instruments, is identifying and studying water ice clouds, carbon dioxide ice clouds, and dust storms," said Dr. Arden Albee, project scientist for the mission. "Cloud formation is almost ubiquitous and highly variable in space and time on a scale of hours. Although a major dust storm was studied around Thanksgiving 1997, dust storms and dust devils are currently quite localized."

"The Global Surveyor spacecraft is continuing to perform normal mapping operations during the four-week long geodesy science campaign that began on May 6," said Joe Beerer, the flight operations manager for Global Surveyor at mission control in Building 264. During this period, Surveyor is returning a very

large amount of science data because it is being watched 24 hours a day by JPL's Deep Space Network antennas. Ten hours each day, the spacecraft returns science and engineering data recorded during the previous 24-hour period. During the remaining 14 hours each day, the spacecraft returns science data in real time (as it is received by the spacecraft) at the high data rate of 80,000 bits per second. These real-time data contain a large number of high-resolution images from the Mars orbiter camera.

At JPL, work during the campaign is much the same as other times in mapping phase: Navigators are doing two orbit solutions per week and provide predictions of future spacecraft positions for the scientists to plan their observations. These predictions are distributed on Monday and Thursday afternoons. The sequence team is building a couple of sequences per month. Sequences are uplinked to the spacecraft and will operate the spacecraft from one to four weeks. □

Significant achievers honored

JPL Director Dr. Edward Stone on May 20 presented 22 individual and 10 team awards to winners of the 1999 Award for Excellence.

Family, friends and colleagues gathered to salute the award recipients during the ceremonies in front of Building 180.

The first tier of the Laboratory's Reward and Recognition Program, the Award for Excellence includes a cash award and a certificate of recognition. Any JPL employee or team who made a significant contribution during the nomination period is eligible for the award. Any employee can make a nomination.

Human Resources Director Susan Henry noted that the approximately 130 nominations were a key element in the success of the program. "Your interest and enthusiasm was evidenced by the quality of the nominations submitted," she said.

"The one-sentence citation on the certificate can't possibly portray the full impact of what you've accomplished, how hard it was, or how many hours it took," Stone told the gathering. "It's because of the innovations and contributions like those recognized today that JPL is widely regarded as leading [NASA] and the world into the third era of space exploration, just as it has led the first two eras."

Stone added that about one-third of the activities honored involved 17 partner organizations along with 33 individuals from industry and academia.

Reward and Recognition Administrator Monica Garcia noted that an Award for

See Excellence, page 6

JPL Director Dr. Edward Stone and Bertha Hines of the Reward and Recognition Program Office prepare to present certificates of recognition to Award for Excellence winners during May 20 ceremonies. Many recipients were joined by their family and friends.



DUTCH SLAGER / JPL PHOTO LAB



Then and now: Voyager planners still on Lab reunite 26 years later

By MARK WHALEN

In 1972, five JPLers who were working on what was then called Mariner Jupiter/Saturn 77 (MJS77), subsequently renamed Voyager, authored an article that appeared in the November 1972 edition of *Astronautics & Aeronautics* magazine. The article, titled "Mariner Jupiter/Saturn 1977: The Mission Frame," included a photograph of the five engineers.

And just as the Voyager spacecraft are still alive and well more than 20 years after their launch, one of the five authors, Roger Bourke, who now coordinates the international elements of JPL's Mars missions, "recently stumbled over this article and recognized that all of us are still alive, well and working at JPL."

"So I rounded up everyone and had the photo retaken, 26-plus years later," Bourke said.

Ralph Miles, mission analysis and engineering manager on MJS77, is actually retired from the Lab, but still works on-call. The other three—Sylvia Miller, Paul Penzo and Richard Wallace—along with Bourke, are still on the job full time.

Miller, who has been with JPL since 1968, is now deputy manager of the Mars Program Planning and Architecture Office. Penzo, who joined the Lab in 1970, is working on developing a launch method to carry a Mars micromission in 2003. Wallace, who started at JPL in 1964, now manages the Space Physics Advanced Missions Section 714, as well as serving as mission and systems manager for Interstellar Probe in Division 860.

Although they went their separate ways after helping to formulate Voyager in its early stages, the five have had the opportunity to touch base now and then.

"One of the nice features of JPL is that people like working here, so they tend to stay for many years and get to know many colleagues," Bourke said. "Often you can call a person you worked with eons ago and ask for help.

"That's a bit of the character of JPL," he added. "I think it says something about us as an institution."

Penzo agreed. He and Miller were both group supervisors in same section years ago, and he and Bourke collaborated on a preliminary Mars sample-return study in 1987. Still, he said, "I was completely sur-



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The five JPL engineers photographed both in 1972 and again recently are, from left, Roger Bourke, Ralph Miles, Paul Penzo, Sylvia Miller and Richard Wallace.



DUTCH SLAGER / JPL PHOTO LAB

prised when Roger called to gather us together again."

Miles retired in 1991 after a 28-year career here. As an on-call employee, he still works one or two days a week in the Reliability Engineering Section 505, performing mission assurance tasks for the proposed Space Interferometry Mission (SIM). Following Voyager, he joined the Civil Systems Program until working on launch approval planning work for Galileo from 1984–87.

"I decided that it would be years before JPL would launch another planetary spacecraft, and that Civil Systems would be an attractive area to pursue," he said. "And, in fact, it was another 12 years before another spacecraft [Galileo] would launch."

Today, with the myriad of missions that JPL supports, what's most ironic is that

Bourke and Miller once again work very closely. She called it a coincidence that they have reunited in work.

Miller was one of the very few women engineers at JPL in the early '70s. "Opportunities for women have certainly blossomed since that time," she noted, "and I'm very pleased to see that."

In leading Space Physics Advanced Missions, which attempts to see mission possibilities five to 20 years into the future, Wallace said he is "not surprised at all" that the JPL of today has so much more on its plate than in the early 1970s. "I'm still doing preliminary design work, which is what I've always wanted to do and have done since 1967.

"That's been my career," he added. "When you work in preliminary mission design, you are eternally optimistic." □

Excellence

Continued from page 4

Excellence display, which includes photographs of the recipients, will be on display in the Building 167 cafeteria until Tuesday, June 1.

Following is a list of award recipients:

Individuals

Business Operations

Jody Brown (Section 231): Significant contribution as a member of the CIT/JPL Prime Contract Negotiation Team.

Mitchell Shellman (346): Significant achievement in the development of the Project Assessment Tool.

Leadership

Daniel Erickson (345): Outstanding leadership as the software manager for the Deep Space 1 spacecraft.

Tooraj Kia (341): Outstanding contribution as the technical leader for the TOPEX/Poseidon Autonomous Maneuver Experiment.

Yunjin Kim (334): Outstanding contribution as the task leader for the Advanced Radar Technology Development Team.

Dankai Liu (341): Outstanding contribution as the avionics PEM in leading the Deep Space 1 Avionics Team.

Steve Ogle (621): Outstanding leadership as the CREI group supervisor.

Gary Parks (722): Outstanding leadership as the Manager for the Interferometry Systems and Technology Section.

Kimberly Shepard (501): Outstanding contribution as the DMIE operations team leader.

Quality

Barbara Cantu (824): Displaying outstanding initiative and dedication in support of the GeoSAR Project.

Jennifer Schlickbernd (893): Outstanding initiative in the development of a process for software dissemination for government-use licenses.

Chi Truong (349): Outstanding dedication, quality and customer service as an assembler working on the Shuttle Radar Topography Mission.

Technical

Mark Drinkwater (323): Significant contributions in the field of polar research.

Bjorn Eng (388): Outstanding achievement as a key contributor on the ASTER Project.

Sarah Gavit (747): Exceptional dedication and contribution in leading the design, building, testing and demonstration of the Deep Space 2 microprobes.

Ali Ghavimi (345): Outstanding achievement as a key contributor on Tropospheric Emission Spectrometer and on the Pioneer Coring Project.

Isk Kanik (323): Significant achievement in the conceptual development of the Proton-Transfer-Reaction-Ion-Mobility Detector.

Soon Sam Kim (353): Significant achievement in the development of miniature Nuclear Magnetic Resonance (NMR) and Electron Paramagnetic Resonance (EPR) spectrometers.

Marc Rayman (746): Significant achievement as a key technical contributor to the Deep Space 1 spacecraft.

David Spencer (450): Significant achievement in the discovery of interplanetary trajectories for Mars 2001 orbiter.

Parag Vaze (313): Outstanding technical contribution in the implementation and operational demonstration of the TOPEX/ Poseidon

autonomous Maneuver Experiment.

Brian Wilcox (345): Significant achievement in the conception and exposition of the Mini-Mars Ascent Vehicle.

Teams

Business Operations

HR Organization & Position Hierarchy Development Team: Significant achievement in the development of the Organization and Position Hierarchy that is critical to the New Business Solutions Project: **Michael Coryell, Richard Hann, Jienming Jou, Diana Lanagan, Dennis Lo, Ronald Reeve.**

SFOF Emergency Generator System Replacement Project Team: Significant achievement in the planning, design and installation of the new Space Flight Operations Facility's replacement generators: **Dale Au, Stephen Brown, Lamont Burgess, Robert Elson, Manoucher Goharizi, David Griffith, Steve Hanson, A S. Krishnan, Pete Lambrecht, Gilbert Ortiz, Victor Reyes, Michael Salsman, Greg Thornton, Bradley Walker.**

Quality

Media Relations Team: Outstanding dedication to customer service and quality in producing JPL program and project materials for the press and the public: **Diane Ainsworth, Jack Dawson, Mary Hardin, Mary Beth Murrill, Franklin O'Donnell, Richard Pavlovsky, Enrico Piazza, Jane Platt, Jurrie van der Woude, John Watson.**

Technical

Deep Space 1 Avionics and Flight Software Team: Significant achievement in the design and development of the avionics and flight software for the Deep Space 1 spacecraft: **Richard Achatz, Ralph Basilio, Jan Berkeley, Shyamkumar Bhaskaran, Douglas Caldwell, Michael Carmel, Daniel Chang, George Chen, Steven Collins, Shailen Desai, Daniel Eldred, Daniel Erickson, Kirk Fleming, Forest Ford, Edward Gamble Jr., Mehran Gangianpour, Donald Gibbs, Peter Gluck, Kim Gostelow, Dongsuk Han, Gregory Harrison, Ricardo Hassan, Robert Hogg, Burton Jaffe, Jim Joseph, Sanjay Joshi, Brian Kennedy, Alfred Khashaki, Sanford Krasner, Philip Kwan, Ching Leang, Jeffrey Levison, Sima Lismann, Dankai Liu, Boris Lurie, Kevin Maguire, Alan Mazer, Elihu McMahon, Steven Mikes, Alex Moncada, Tracy Neilson, Donald Nieraeth, Paula Pingree, Christine Preheim, Marco Quadrelli, Joseph Riedel, Nicolas Rouquette, Gurkirpal Singh, Samuel Sirlin, Robert Valencia, Charles Vanelli, Ashton Vaughs, John Walker, Monica Wang, Udo Wehmeier, Robert Werner, Jonathon Yount, Elaine Zamani.**

Deep Space 2 Packaging and Mechanical Team: Significant achievement in the design, development, packaging and assembly of the Deep Space 2 spacecraft: **Genji Arakaki, Sharon Barr, Donald Bickler, Gregory Boreham, Sylvia Chavez, Charles Cruzan, Saverio D'Agostino, Chuck Derksen, Khanara Ellers, Faramarz Keyvanfar, Satish Krishnan, Robert Moncada, Annette Nasif, Frank Ramirez, Tommaso Rivellini, Bruce Scardina, Eric Slimko, Kathleen Sowles, James Stone, James Stultz, Christopher Voorhees, Karl Yee.**

Deep Space 3 Concept Team: Significant achievement in the development of a two-spacecraft architecture for the Deep Space 3 Project: **William Folkner, Peter Gorham.**

MMIC Low Noise Amplifier Development Team: Significant achievement in the development and demonstration of InP MMIC amplifiers: **Michael**

Barsky, Yoke Choy, Neal Erickson, Todd Gaier, Richard Lai, Charles Lawrence, Matt Nishimoto, Alejandro Peralta, Lorene Samoska, Roger Tsai, Sander Weinreb, John Wielgus.

MSOP/MGS Aerobraking Navigation Team: Significant achievement in exceptional planning and execution of Mars Global Surveyor aerobraking through Mars' atmosphere: **Vijayarag Alwar, Paul Burkhart, Stuart Demcak, Pasquale Esposito, Eric Graat, Martin Johnston, Brian Portock.**

MVACS Team: Significant achievement in delivering the Mars Volatiles and Climate Surveyor integrated payload to the Mars Surveyor '98 Project: **Gina Alleruzzo, Donald Bickler, Bruce Bon, Robert Bonitz, David Braun, Carl Buck, David Crisp, Robert Denise, Ron Dotson, Siamak Forouhar, Barry Goldstein, Candice Hansen, Jennifer Herman, Alan Hoffman, Stephen James, C. Eric Kurzwil, Clayton La Baw, Paul MacNeal, J.C. Mahoney, Ramachandra Manvi, Nancy Marmor, Randy May, James McGown, Donald Meyer, David Nakamoto, Don Noon, Deborah Padilla, Young Park, Gregory Pixler, Peter Rentz, Raul Romero, Orin Serviss, Jeffrey Slostad, Thieu Ton, Mau-Huu Tran, Robert Troy, Rudolph Vargas Jr., Nancy Walizer, Liang-Chi Wen, Wayne Zimmerman, Richard Zurek.**

TOPEX/Poseidon Autonomous Maneuver Experiment Team: Significant achievement in successfully conceiving, designing and implementing The TOPEX/Poseidon Autonomous Maneuver Experiment: **Abdullah Aljabri, Ronald Boain, Mark Fujishin, William Hullinger, Tooraj Kia, Allan Klumpp, Beth Lee, Ho-Sen Lin, Jeffrey Mellstrom, William Mitchell, Martin Nachman, Paul Sanneman, Kuei Shen, Parag Vaze.** □

NOVA

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Stephan James, Sid Johnson, Russell Lawton, Rosa Leon, Tetsuo Miyahira, James Okuno, Bernard Rax, Ronald Ruiz, Frank Stott, Jose Uribe, Duc Vu, Joanne Wellman, Jing Yuan.

Section 510: Parvin Forouhar.

Section 515: David Guarino, Michael Taylor, Mona Witkowski.

Section 516: John Scott Michel.

Section 518: John Borthwick, Pamela Distaso, Stan Eisenbaum, Steve Heard, Dan Hoffman.

Section 640: Cary Fox.

Section 642: Queen Allen, Susan Argenio, Marcos Falcon, Jerry Kalish, Ed Contreras, Michael Nieto, Michael Wright, Suzette Baugh.

Section 644: Pat Ehlers, Bob Niedzialek, Clarise Okwach, Daina Parlee, Donna Pederson, Krystal Poole, Chester Reyes, William Sarkisian, Daria Topousis, Sandra Menotti, Steve Benskin, Robert Brown, Kimberly Cook, Dave Deats, Terry Griffin, Richard Hasegawa, Ralph Kagan, Carol Lachata, Holli Leonard, Sadr Mohsenin, Caroline Reed, Carlos Rolon, Thomas Wynne. □

Volunteer

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Facility by way of his background as a certified nuclear welder and computerized tool operator.

This year, Wilcox, now a member of the Prototype Sheet Metal and Technician Support Group, will be the one demonstrating the precision tool to open house visitors.

It was a big decision for Wilcox to leave a 17-year job with Dragon Valves of Norwalk to join JPL and

as a contractor employee with ACRO. But there is even more to the story and his decision.

It turns out that Wilcox has taken extensive computer programming courses and specific experience with the PC-based LINUX operating system and has been a community volunteer to the Telescopes in Education Project through JPL's Educational Affairs Office since 1994. Gil Clark, who administers Telescopes in Education, had met Wilcox through the Orange County

Astronomers Club and asked him to set up the TIE web site (<http://tie.jpl.nasa.gov/tie/index.html>), for which he continues to serve as site webmaster.

So, Wilcox was very familiar with JPL and its astounding work. "But," he said, "until I had the opportunity to tour JPL and to see first-hand just how extensive the Lab is, I had actually never thought

it might be possible to work here. Now, in less than a year, I've worked on 10 different projects.

"JPL's open house is quite an event, for me; it has changed my life," he said. "I really enjoy the work at JPL, and you could almost say that I get paid to have fun!" □

—Tony Kramer
*Outer Planets/
Solar Probe Project outreach*

Solar Probe Project outreach

Job applications again accepted at open house

More than 300 job seekers submitted resumes to JPL during last year's open house, and once again members of the public may apply for job openings at next Saturday and Sunday's event.

"The open house will provide an excellent opportunity for JPL to recruit potential employees from the local area," said Cynthia Chinn, manager of the Staffing and Professional Development Section 195.

She said resumes will be accepted and brief interviews granted at the employment booth to those interested in potential work at JPL. "Resumes will be scanned into an automated artificial intelligence system that matches an applicant's job skills to openings on Lab," Chinn said. Applicants who apply for JPL employment will receive acknowledgment of their interest. Resumes will be retained for matching against open positions for approximately six months.

Members of the public may also apply for JPL jobs through the Internet. Open positions are posted on the World Wide Web at <http://www.jpl.nasa.gov> at the "Employment" link. Resumes are also accepted via e-mail at jobs@jpl.nasa.gov. □



At last year's open house, Roger Wilcox saw a demonstration of the Bengal Waterjet machine, above, and decided to apply for a job on Lab. This time around, he will be the one showing members of the public how the machine cuts steel with water.

LETTERS

Thank you to the ERC for the lovely plant and for all the cards and letters of sympathy. My brother's death took my family by surprise. But the support of colleagues, and the kind words from my friends at JPL, have been deeply appreciated. My children will be creating a living garden with the ERC plant, in honor of their uncle. Thank you all.

Alice Wessen

FOR SALE

AUDIO EQUIPMENT, top of the line Philips, FR 940, 100W stereo receiver w/variable digital delay, Dolby Pro Logic w/full function remote for complete system; CDC 935, 5-disk carousel CD changer w/digital output and favorite track selection; FC 930, dual-well double auto-reverse cassette deck w/4-motor operation, like new, \$325. 626/359-7666.

AUTOBIKE mountain bike w/automatic gear-shifting technology, accessories included, \$100. 626/798-3989.

BABY ITEMS, high chair, \$15; changing table, \$20. 909/596-5774.

BED, queen-size platform, with pedestal drawers (six) and matching bookcase headboard, \$150/obo. 249-4096.

BIKE, road, Bianchi Limited, lg. frame, Shimano 600 equipped, exc. cond., needs tires, \$400. 248-6721.

BICYCLES, (1) 26" Specialized Crossroads Expert, 20" aluminum frame, 21 speed, nvr. used, assembled, \$160; (2) 26" Specialized Hardrock classic mountain bikes, 21" frame, 21 speed, in box, \$150. 626/732-2941.

CELL PHONE, Motorola Star Tac, with case/charger (\$39); PAGER, Motorola Gold flex alphanumeric message, almost new (\$69); SATELLITE DISH, Sony 18" (\$49); SOFTWARE, Microsoft

Publisher 97 (\$15), New Microsoft Picture it (\$15), Word 97 (\$12), Eudora 4.0 (\$9), Adobe Photo Delux (\$9), Photo Studio (\$9), Windows Draw Print Studio, Premier CD (\$9). 366-6134.

CELL PHONE, Nokia, \$50; CARPET, Chinese, large, \$300; BABY SWING, like new, \$40; BABY BOUNCE CHAIR, \$10. 626/799-6196.

CEMETERY PLOTS (4), adjacent, in Cypress Lawn Section of Rose Hills Memorial Park in Whittier, all 4 for \$2,500 cash. 805/739-9204.

CHINA SET, 60 pieces for \$70/obo. 909/592-0780, Ana.

COMPUTER, Mac II FX, Conner 20 MB HD, 780 kB 3.5" FD, 1.4 MB 3.5" FD, 20 MB RAM, System 7.5.3, 32-bit addressing, 14" color monitor (16 colors), Global Village Teleport 33.6 fax/modem, Netscape Communicator 4.04, \$175. 541-0062.

COUCH and CHAISE, great condition, super-wide couch, blue and white fabric, huge chaise ultra-comfy, same fabric; together or separately, slip-cover extra, \$350 + \$200. 626/304-9304.

CROCK POT square by Rival with Corningware, \$12/obo. 626/568-8298.

DARKROOM, complete for home, Beseler 35mm, 2 1/4 enlarger, color head, color print dev. tanks, trays, timers, print dryer, mounting press, film dev. tanks and more, \$200/obo. 626/798-3989.

DINNER JACKET, formal, burgundy, like new, size 40 long, \$35; BUSINESS SUIT, 3-piece men's, gray, like new, size 38 long, \$42. 626/793-1895.

DRESSER/CHANGER for baby, white, \$50; baby car seat/carryer \$25; high chair \$50; misc. baby items & toys at reasonable prices; BREAKFAST TABLE & CHAIRS (4), \$150; COUCH, beige sectional, almost new, \$350. 248-8853.

DRESSES, new, Julian Taylor, royal blue, 14 & Halston, black, 12, \$25/40. 626/398-4960.

EXERCISE MACHINES, Voit "Torso Trainer", Model 808; Brenda

DyGraf "In-Stride Walker" Model 55-1350; Tony Little "For Women Only" (1-on-1 trainer); \$80/each; get in condition for summer fun early. 790-6283, Bob, after 5 p.m.

FISH, freshwater, moving, must sell; peaceful community tank, mature fish; gold severums (mating pair), clown loaches, bala sharks (large), angelfish (large), jurapari, chocolate cichlids, more; \$10/each/obo. 626/794-2758, Betsy Wilson.

FOOTBALL CARD, Randy Moss (Vikings' rookie of the year) autographed 8 x 10 w/certificate of authenticity, \$80; unopened boxes of baseball/football packs, various prices and years, \$25-\$100; 2 boxes '92 Upper Deck baseball cards, 36 unopened packs, \$25/ea. 626/914-6083.

FURNITURE: sofa, gray velvet, nice & clean, \$85; office desk, glass top on black metal frame, like new, \$100; 2 wood stools, natural color w/black legs, \$50/pair. 626/744-9040.

GOLF CLUBS, Jack Nicklaus left-handed N-1 graphite irons, 2-SW + 60 degrees lob wedge, driver, 3 wood, bag, putter, \$75/obo. 626/798-3989.

GUITAR, Peavey Wolfgang Spec., exc. cond., \$700 with case. 952-8812, Steve.

INTERCOM/SPEAKER PHONE, AT&T, four lines, model 854, new in box, \$100/ea., \$175/both. 626/744-9040.

KILNIMS, Persian, assorted colors & patterns, sizes vary from 6' x 4' to 9' x 5'; all are nice w/no damage/tears, \$40-\$300/ea. 626/744-9040.

MICROWAVE Oven, Gold Star, 10 mos. old, excellent cond., \$50. 661/273-5848 (Palmdale).

MODEM, Apple Geoport adapter fax/modem, Model M1694 express for power Mac, \$25. 541-0062.

MONITOR, Magnavox 14" color for Macintosh, excellent resolution/contrast/condition, yrs. left, \$50. 626/441-8572.

MOVING SALE: big-screen TV, \$750; queen bed set, \$300; girl's

Continued on page 8

bed set, \$250; sec. couch, \$300; refrig., \$300; washer/dryer, \$300. 952-8749.

MOVING SALE: microwave oven, Panasonic, 1 yr. old, \$60; vacuum cleaner, Panasonic, 2 yrs. old, \$50; mattress, twin, \$30; TV, 19" Daewoo, 2 yrs. old, \$50; refrigerator, Kenmore, frost-free, \$90; table, 40" x 18", w/drawers, \$20. 626/447-1985.

PHOTOS: 40" x 30", color, framed, 2 tall-ship pictures taken by prof. photog., vg cond.; 1 of Span. ship in SF Bay, 1 of German ship nr Puerto Rico; \$70/ea, \$120 for both/obo. 626/568-8298.

PICTURE FRAMES, three made of brass, 22" x 28", \$7/each, \$18 for all three/obo. 626/568-8296.

PRINTER, Xerox Diablo 630, w/wheels/ribbons, exc. cond., \$10/obo. 626/568-8298.

RING, amethyst w/diamonds, set in 14K gold (women's), \$125. 626/398-4960.

SOFA, sleeper, Thomasville queen size, plaid upholstery, pale rose with blue, green, cream, good condition, \$350. 790-0335.

TABLE SAW, Rockwell 10", low hours, very clean, \$350/obo. 626/303-5595.

TABLES, glass, four 2-shelf tables with brass feet, three make up coffee table (one round 2.5-ft. dia., two "half-moon"), fourth is round end table (2.5-ft. diam.), \$125/obo. 909/592-0780, Ana.

TELEPHONE ANSWERING MACHINE, General Electric, black, microcass., voice time/day stamp, hardly used. 626/844-4383.

TENNIS RACKET, Prince Magnesium Pro, never been used; w/cover, \$40 firm. 626/441-8572.

TIRES, 4 Bridgestone Turanza P175/70 R 13, lots of miles left, \$10/each, or \$35 for the set. 790-5341.

TOOL BOX, aluminum, MFR highway products, fits GM or Ford 250 pickup truck, interior light, removable sliding tray, spray can/oil rack, exc. cond., \$625 new, sell \$275. 626/798-3989.

VIDEO GAME, Sega system with 1 controller and 6 games, excellent condition, games are: Batman Returns, Herzog Zwei, Joe Montana II Football, Super Hang-on, Sonic the Hedgehog, and John Madden Football, \$50. 626/797-9846, eves.

WEDDING DRESS, exc cond, used once, in garment bag; white, straight, long sleeves, bow in the back, \$40/obo. 626/568-8298.

VEHICLES / ACCESSORIES

'91 ALFA Spider, 5 spd., silver ext., tan interior, loaded, new top, new tires, 45k mi., mint condition, must sell, \$11,500/obo. 323/935-9031.

'92 BUICK LeSabre, loaded, leather interior, probate sale, \$7,000. 248-1856, Gordon.

'94 BUICK Park Avenue, metallic beige, excellent condition, original owner, touring package, owners/service/electrical systems manuals included, \$11,000. E-mail: Isukamoto@aol.com.

CAR COVER made for Lexus ES300, bought from dealer with purchase of car, \$75/obo. 626/568-8298.

'91 CHEVROLET Camaro, 74k miles, baby blue exterior/light gray interior, loaded, AM/FM Kenwood stereo w/cassette and face attachment, pwr. steering, pwr. doors and windows, ABS brakes, air bag, \$6,000/obo. 875-4744, Aaron.

NOTICE TO ADVERTISERS

All housing and vehicle advertisements require that the qualifying person(s) placing the ad be listed as an owner on the ownership documents.

Universe

Editor

Mark Whalen

Photos

JPL Photo Lab

Universe is published every other Friday by the Public Affairs Office of the Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, Pasadena, CA 91109.

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Ads must be submitted on ad cards, available at the ERC and the Universe office, Bldg. 186-118, or via e-mail to universe@jpl.nasa.gov. E-mail ads are limited to six lines.

Ads are due at 2 p.m. on the Monday after publication for the following issue.

To change an address, contact your section's administrative assistant, who can make the change through the HRS database. For JPL retirees and others, call Xerox Business Services at (626) 844-4102.

'86 CHEVROLET Corvette, gold (new paint), auto, T-top-clear, am/fm/cass., runs strong, near-new tires, 90,000 mi., \$10,000/obo. 909/264-2284.

'86 CHEVROLET Suburban, AT, 3/4 ton, 454 V8, towing pkg., all pwr., front/rear ac, 3rd seat, lim. slip diff., alloy wheels, tilt whl., cruise cont., trailer hitch, roof rack, bronze/tan, 155K miles, vg cond., all maint. rec., \$6,500. 247-0831.

'85 FORD Mustang GT, built 302, brand new 5-sp., 3-55 gears, flowmaster exh., '91 rear end, '91 front suspension, very fast, very nice, must sell, \$4,500/obo. 790-6283 or 323/780-7816.

'85 FORD Ranger pickup, good working truck, longbed, runs well, 170,000 miles, \$650. 626/799-6196.

'98 HONDA Civic LX, dark green w/tan interior, 5 sp., tinted windows, alarm w/remote, pwr. w/d, cruise, tilt, AM/FM/CD, great gas mileage (35 mpg avg.), 18,500 mi., \$13,500/obo. 562/409-6263.

'91 HONDA Prelude 2.0 Si, white, 5 speed, excellent condition, am/fm/CD, moon roof, power locks and windows, alarm, 120k miles, \$7,200. 626/963-7197.

'83 HONDA AT200X, runs well, \$250/obo. 626/303-5595.

'94 JEEP Cherokee, white w/tan interior, 2W drive, great cond., \$7,500. 626/614-0984, Debbie.

'90 JEEP Cherokee Laredo 4D, 4WD, 6-cyl. 4L inj., automatic, ABS, air cond., all pwr., cruise ctrl., stereo, roof rack, priv. glass, towing pkg., alloy whls., new batt./tires, excellent condition, only 61,000 miles, \$7,800. 626/793-6733.

'98 LEXUS ES 300, auto, loaded, sunroof, leather seats, 4,000 miles, black, like new, salvage title, \$22,750/obo. 909/599-3230.

'87 MAZDA 323 LX, 4 door, a/c, am/fm/cassette, 63K mi., exc. running cond., \$3,300. 626/447-1985.

'97 NISSAN Altima GXE, auto, power windows/door locks/antenna, cruise control, tilt wheel, a/c, am/fm/cass., exc. cond., 21,000 miles, \$11,500/obo. 909/599-3230.

'95 NISSAN Maxima, dark blue, dark gray interior, 55K miles, sunroof, 24 valve, factory alloys, all records, oil change every 3,500, recent tires & brakes, very nice, \$12,500 firm. chavez@alum.mit.edu, 626/798-4740.

'96 OLDSMOBILE, 4-dr. sedan, 12,300 mi., exc. cond., \$9,200. 626/355-8628.

POLARIS watercraft (2), with trailer, exc. cond., \$8,700 for both. 951-1449.

'77 PONTIAC Trans Am, red ext., white int., auto, a/c, runs very well, must sell, \$1,200/obo. 790-6283 or 323/780-7816.

'91 SAAB 9000 turbo hatchback, 87K miles, clean inside and out, automatic, dual SRS, black w/tan leather interior, power windows/locks/steering, alarm, premium wheels, dual heated and power seats, ABS (4-wheel), cruise control, a/c, am/fm cassette, sunroof, \$10,000/obo. 626/744-9412.

'88 SAAB 9000 turbo, runs well, good condition, sunroof, heated seats, \$2,800/obo. 626/584-4429.

'91 TOYOTA Previa LE van, runs well, all maint. updated, 125,000 miles, only 2 owners. 957-7468.

'92 VW Corrado SLC VR6, classic green/beige leather, rare AT, ABS, sunroof, a/c, alloy wheels, prem. sound, am/fm/cass., all avail. options, low mi., exc. cond., orig. owner, \$14,500. 247-0831.

'87 VW Cabriolet, great cond., maroon, sand top, 5-speed manual, new tires, new windshield, timing belt changed recently, runs great, visible on Lab every day, 140K miles, \$2,700/obo. 626/304-9304.

'95 VW Jetta, 72K mi., 5 sp., CD chgr., sunroof, power with gas economy (33 mpg), exc.t cond., fun to drive, \$9,000/obo. 951-3566.

FREE

DOG, female Akita, 4 years old, sweet and affectionate, needs loving home. 626/584-1323.

DOG, Border Collie, turned 2 last Oct., high energy, and her husband Chow/Lab (will be 2 in July), gd. home w/lg. yd.; med. size dogs, very loving & smart, sterile, attention lovers; prefer to keep together; their children, 2 outside cats (sterile), optional. 353-5342.

WANTED

HOUSE for rent by visiting professor to JPL; he will visit from Germany with his family Sept. 1, '99 - Feb. 28, '00; needs 3 bedrooms or more; e-mail: klingen@esprit.iwr.uni-heidelberg.de or call 909/607-4349, Lynn.

SPACE INFORMATION/memorabilia from U.S. & other countries, past & present. 790-8523, Marc Rayman.

FOR RENT

ALTADENA house, 2 bd., 1 ba., DR, den, 1-car garage, avail. 15 June, \$1,050. 857-3675.

ALTADENA "mini-mansion," 4 bd., 2 ba., pool, spa, cent. a/c & more, \$1,850. 626/794-7281.

ALTADENA, room in 3-bd., 2-ba. house, full privileges, kitchen, laundry, pool, pool table, a/c, no smoking, 5 min./JPL, \$400 + 1/3 util. + deposit. 626/398-3649, Jennifer.

LA CANADA, immaculate house, 3 bd., 1.5 ba., central heat/air; remodeled kitchen w/refrigerator, stove, dishwasher; detached garage w/washer, dryer, some storage; patio & fenced back yard, \$1,800 (incl. water & gardener) + \$1,800 security deposit; 1-yr. lease preferred, available July 1. 952-9114.

LA CANADA guesthouse w/its own st. address/mail service, 1 bd., includes off-st. parking, water, gardeners, shared access to tennis courts, \$840. 952-1304.

MONTROSE apt., 1 bd., 1 ba., a/c, garden, off-st. pkgng., Indry., charming, trash/wtr/grdnr. pd., 10 min./JPL, walking dist. to Montrose Mall, \$635. 248-4637.

PALM SPRINGS condo, 1 bd., compl. furn., pool, spa, tennis,

cable, VCR, carpet, paint, furnishings new; daily, weekends, weekly, monthly. 626/445-0884.

PASADENA, room in 3-bd. apt to share with 2 others, pool, parking, a/c, washer/dryer; \$460 + 1/3 utilities. 626/564-1078.

ROOM in lg. house close to JPL, furn. or unfurn., shared ba., kitchen/hallway privileges, non-smoker, clean, must like dogs, \$450 + 1/2 util. unfurn., \$500 + 1/3 util. furn. 626/797-5570.

SIERRA MADRE, quiet 2 bd., 1.5 ba., lg. apt., mtn./valley views (top of Baldwin Ave.), lg. balcony, \$820. 626/355-7318.

REAL ESTATE

BIG BEAR, new cabin 2 blocks from lake, 2 bd., 2 ba., mud/laundry room, \$129,000. 909/585-9026.

HOLLYWOOD, on Franklin Ave. west of La Brea, walking distance to Hollywood Bowl, 500 sq. ft. carpeted studio, full bath, plenty closet space, large kitchen, 2-car private parking, Olympic-size pool, Jacuzzi, security gates, 2 men & women's gym, 3 laundry rms., party rms., excellent rental property, sale by owner, \$65,000. 909/599-9543.

LA CRESCENTA, 4 bd., 2 ba. + loft, Jacuzzi tub, 2 fireplaces, lots of storage, beautiful park-like yd. w/pool, covered brick patio w/benches & gas bbq, surrounded by trees, double garage, on private drive, Glendale schools, \$429,000. 248-1997.

PASADENA, 3-bd., 2-ba. home in Lower Hastings; move-in condition, new roof, new copper plumbing, hardwood floors, cent. air/heat, upgraded kitchen, new paint in/out, lg. fenced yd. in rear, 15 min./JPL, \$349,500. 626/446-1140.

VACATION RENTALS

BIG BEAR, 7 mi. from slopes; full kitchen, f/p, 2 bd., 1 ba., sleeps 6; reasonable rates; 2-night minimum; no smokers, no pets; exc. hiking, biking, fishing nearby. 909/585-9026, Pat & Mary Ann Carroll.

BIG BEAR cabin, quiet area near village, 2 bd., sleeps 8, completely furnished, F/P, TV/VCR, \$75/night. 249-8515.

BIG BEAR LAKEFRONT lux. townhome, 2 decks, tennis, pool/spa, nr. skiing, beaut. master bdrm. suite, sleeps 6. 949/786-6548.

CAMBRIA, ocean front house, exc. view, sleeps up to 4. 248-8853.

HAWAII, Kauai condo, 2 bd., 2 ba., full kitchen, sleeps 6, Embassy Suites on beach, available Aug. 24-31, breakfast and nightly cocktails included; regularly \$395/night, need to sell for \$1395/obo. 626/683-9331.

HAWAII, Kauai ocean front condo, 1 bd, 1 ba., sleeps 4, full kitchen, pool, Jacuzzi, BBQ, anytime this year, \$100/night, need to make reservation by June 30, 1999 (timeshare). 213/296-6641.

HAWAII, Maui condo, NW coast, on beach w/ocean vw., 25 ft. fr. surf, 1 bd. w/loft, compl. furn., phone, color tv, VCR, microwave, dishwasher, pool, priv. lanai, slps. 4, 4/15-12/14 rate: \$95/nite/2, 12/15-4/14 rate: \$110/nite/2, \$10/nite/add'l person. 949/348-8047.

LAKE TAHOE, North Shore, 2 bd., 2-1/2 ba., sleeps 6-7, private sandy beach, great location, all amenities, pool, walk to golf course, fishing 150 yards from front door, great hiking, kayaking, river rafting, bike trails, 2 miles/casinos, \$650/week summer season. 626/355-3886, Rosemary or Ed.

MAMMOTH condo, studio + loft, 2 ba., fireplace w/wood supplied, Jacuzzi, sauna, game rm., color cbl. TV/VCR, full kitchen w/microwave, terrace, view, amen. 714/870-1872.

MAMMOTH condo in Chamonix, 2 bd., 2 full ba., slps. 6, fully eqpd. elec. kitch., microw. & extras, frpic/wood, color TV, VCR, FM stereo, o/d Jacz., sauna; gm., rec. & Indry. rms., play & BBQ areas, walk to shops, lifts; special midweek rates; summer rates May. 249-8524.

MAMMOTH, Snowcreek, 2 bd., 2 ba., + loft; sleeps 6-8; fully equip'd kitch. incl. microwave, D/W, cable TV, VCR, phone, balcony w/mtn. view, Jacz., sauna, streams, fishponds; close to Mammoth Creek; JPL discount. 626/798-9222 or 626/794-0455.

MAZATLAN, week of Oct. 11-18, 1-bd. condo, sleeps 6, on the beach, partial kitchen, \$1,050. 626/917-0231.

OCEANSIDE, on the sand, charming 1 bd. condo, panoramic view, walk to pier or harbor, pool, spa, game rm., sleeps 4. 949/786-6548.

PACIFIC GROVE house, 3 bd., 2 ba., fp, cable tv/vcr, stereo/CD, well-eqpd. kitch. w/microw., beaut. furn., close to golf, beaches, 17 Mile Dr., Aquarium, Cannery Row, JPL discount. 626/441-3265.

PALM SPRINGS condo, 1 bd., compl. furn., pool, spa, tennis, cable, VCR, carpet, paint, furnishings new; daily, weekends, weekly, monthly. 626/445-0884.

ROSARITO BEACH condo, 2 bd., 2 ba., ocean view, pool, tennis, stroll walk to beach on priv. rd., 18-hole golf course 6 mi. away, priv. secure parking. 626/794-3906.

Ad deadline extended

Due to the Memorial Day holiday and the late delivery of this issue, the ad deadline for the June 11 issue of *Universe* has been extended to Wednesday, June 2, at 2 p.m. □